

Abstract

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Thesis title Study on evapotranspiration and canopy photosynthesis during and after rainfall in a Japanese cypress forest

(降雨中・直後のヒノキ林における蒸発散および群落光合成に関する研究)

This study used an enclosed-path gas analyzer for the continuous ecosystem fluxes observation in a temperate evergreen coniferous (Japanese cypress) forest in the Asia monsoon area. In canopy-wet period, simulation of different interception situations (wet area ratio and water storage capacity) by a multilayer model was combined with eddy covariance measurement to evaluate interception evaporation from the abaxial surface of leaves, and the relationship between abaxial interception and wet canopy photosynthesis. For the canopy-dry period, the gas exchange of dry canopy at different periods after wetness ended was compared and evaluated to verify the lasting effect of rainfall improving dry canopy gas exchange. The comparison of the simulated and observed latent heat flux(λE) suggests the occurrence of interception evaporation from both sides of leaves at the wet Japanese cypress forest canopy. This phenomenon is more likely to happen after heavy rainfall, while the abaxial surface may not be fully wet as the adaxial surface after small rainfall. The comparison of the simulated and observed net ecosystem exchange (NEE) suggests that the abaxial surface of Japanese cypress leaves was only partly wet by interception during and after rainfall, thus the wet canopy can maintain depressed photosynthesis. The averaged and accumulated NEE showed the wet canopy CO₂ uptake is mainly contributed by the photosynthesis at the post-rainfall canopy-wet period rather than during-rainfall period. The increased gas exchange (λE and NEE, and canopy conductance) was found at the dry canopy immediately after wetness ended, suggesting the positive effect of rainfall-induced leaf wetness on forest gas exchange. These results indicate the ecological value of rainfall-induced leaf wetness to the temperate evergreen coniferous forest gas exchange and revealed the mechanism of wet Japanese cypress canopy maintaining gas exchange.